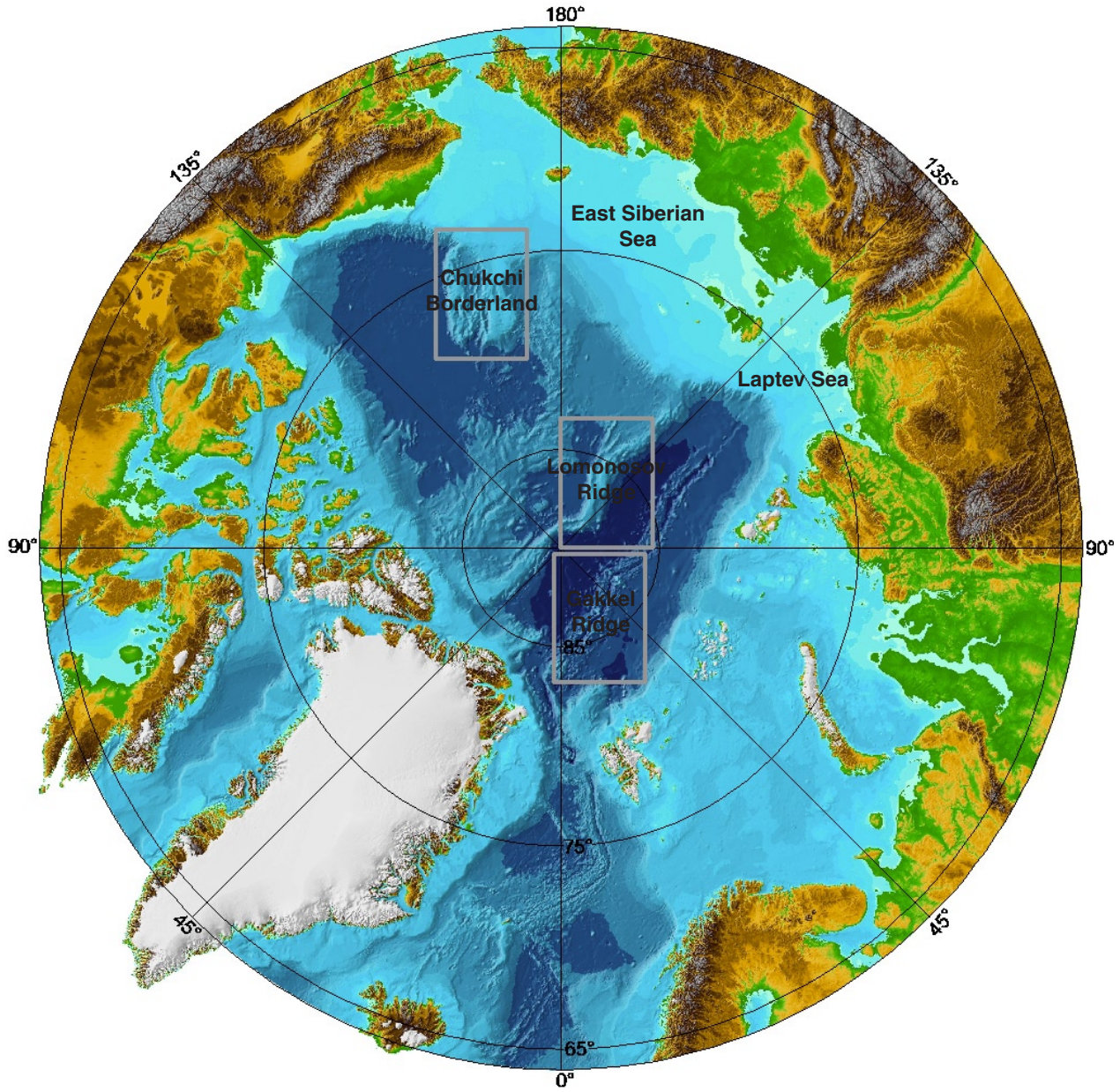
GEBCO (1979) AND IBCAO (2000) MAPS
SELECTIVE COMPARISONS



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SELECTIVE COMPARISONS OF GEBCO (1979) AND IBCAO (2000) MAPS

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Introduction

For over two decades Sheet 5.17 of the General Bathymetric Chart of the Oceans (GEBCO, Canadian Hydrographic Service, 1979) served as an authoritative portrayal of the seafloor north of 64°N. While this contour map provided a general description of major features of the seabed, evidence was accreting to indicate that many of the smaller and scientifically significant features were poorly or wrongly defined.

The International Bathymetric Chart of the Arctic Ocean (IBCAO) was developed from an accumulation of bathymetric measurements collected during past and modern expeditions. The undertaking has produced a 2.5 x 2.5 km grid and derivative maps (Jakobsson *et al.,* 2000) that represent a considerable improvement over previous descriptions of the morphology of the Arctic seabed. The most substantial improvement is in the central Arctic Ocean, where a nearly empty database was significantly enriched by the addition of historic and modern observations collected by US and British submarines (DeLaca and Gossett, 1996; Showstack, 1997), by Swedish and German icebreakers, and by depths derived from a new contour map prepared by the Russian Navy (Head Department of Navigation and Hydrography *et al.,* 1999). The database for the shallow shelves of the Laptev and East Siberian Seas has been enhanced as well, absorbing a large quantity of depth values that were extracted from a suite of small scale navigational charts issued by the Russian Navy.

This note provides examples of the above improvements by contrasting the GEBCO and IBCAO representations of the seafloor in four regions of the Arctic Ocean: the Gakkel Ridge, the Lomonosov Ridge, the Chukchi Borderland, and the continental shelves of the Chukchi, Eastern Siberian and Laptev Seas. These regions are shown on the cover page.

The GEBCO information that was used in this comparison was actually taken from a digital rendition of GEBCO Sheet 5.17, constructed from bathymetric contours that were distributed on CD-ROM as part of the GEBCO Digital Atlas (Jones *et al.,* 1994). The contours were used to develop a Cartesian depth grid (5 x 5 km grid cells) on a polar stereographic map projection with the true scale at 75°N (Geological Survey of Canada, 1994). These map parameters are consistent with the original paper map, and they are also compatible with those of the new IBCAO map. Both the GEBCO and the IBCAO grids were created by means of the GMT program *surface* (Smith and Wessel, 1990). The comparisons that follow consist of side-by-side shaded relief portrayals of three study areas, constructed from the GEBCO and IBCAO grids using identical illumination parameters and color tables (Figure 1).

Figure 1. The color table used to create the shaded relief maps in figures 2-5.

The Gakkel Ridge

The Gakkel Ridge is a spreading ridge that separates the Nansen and Amundsen Basins. It is a continuation of the mid-oceanic ridge system into the Arctic Ocean (e.g., Johnson and Heezen, 1967; Vogt, 1986).

The GEBCO map portrays the western end of the Gakkel Ridge with a smooth and highly generalized morphology (Figure 2). On the IBCAO map, the Ridge flanks feature a blocky configuration, while the Ridge's axial valley is continuous, more pronounced, and deeper, reaching depths below 5000 m and containing several inter-axial highs.

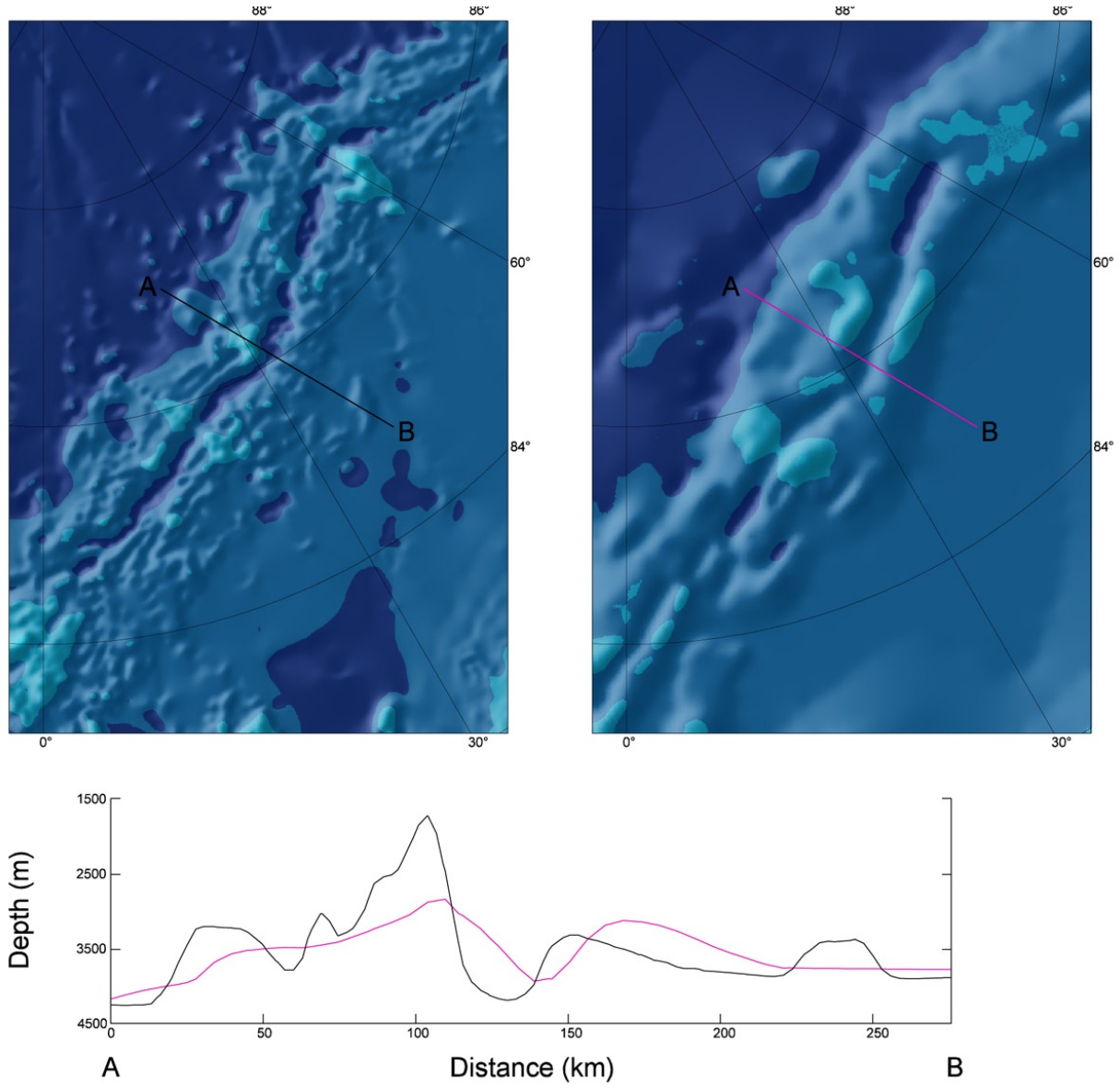

Figure 2. A comparison of the Gakkel Ridge, portrayed by IBCAO (left) and GEBCO (right).

The Lomonosov Ridge

Measuring about 1700 km in length, the Lomonosov Ridge is considered to be of continental origin, a sliver that was separated from the Kara and Barents shelves and transported to its present position by sea-floor spreading (e.g., Sweeney *et al.,* 1982; Kristoffersen, 1990).

On the GEBCO map, the Lomonosov Ridge is a continuous feature that extends from the continental shelf off Ellesmere Island towards the North Pole, where it changes direction

slightly and continues along the 140°E meridian to the continental shelf off the New Siberian Islands. The most striking discrepancies between the GEBCO and IBCAO portrayals occur between the North Pole and the Siberian continental shelf (Figure 3). The new model shows a far more complex morphology, with a ridge that is broken into several smaller segments, and a pronounced kink that projects into Amundsen Basin. Moreover, the crest is generally shallower, wider, and notably flat-topped at several sections.

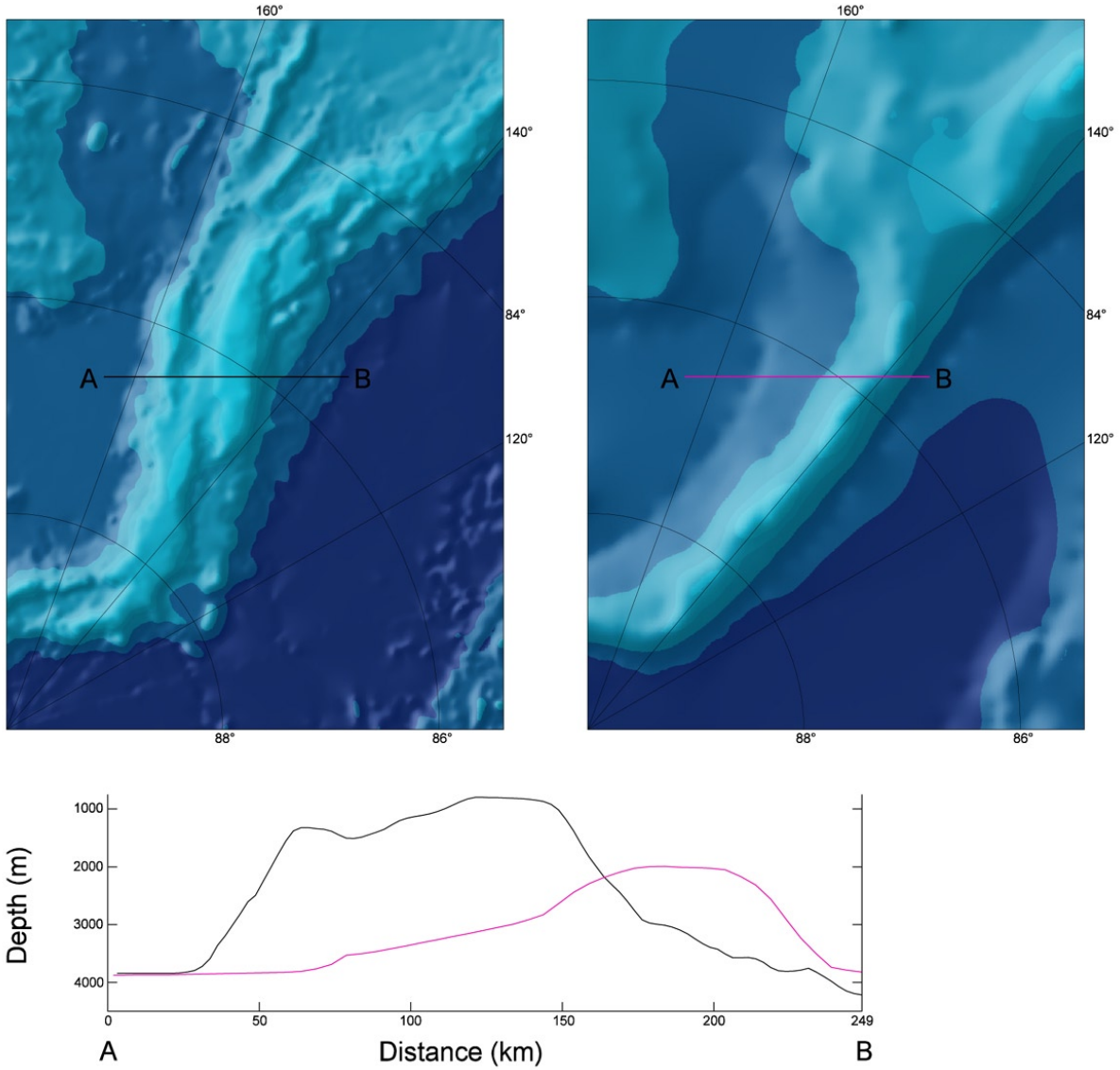

Figure 3. A comparison of the Lomonosov Ridge in the vicinity of the North Pole, portrayed by IBCAO (left) and GEBCO (right).

The Chukchi Borderland

Measuring about 600 by 700 km, the Chukchi Borderland extends from the continental shelves of Eastern Siberia and Western Alaska into the deep Amerasian Basin. It contains three north-south trending structures: Northwind Ridge, Chukchi Cap and Arlis Plateau - the last feature is commonly considered to be a part of the Mendeleev Ridge. Adjacent to these ridge-like structures lie the Northwind, Chukchi and Mendeleev Abyssal Plains.

GEBCO and IBCAO comparisons are limited here to the Northwind Ridge and the Chukchi Cap. Both are among the more extensively mapped features in the Arctic Ocean, see e.g. the compilation map published by the US Naval Research Laboratory (Perry et al., 1985).

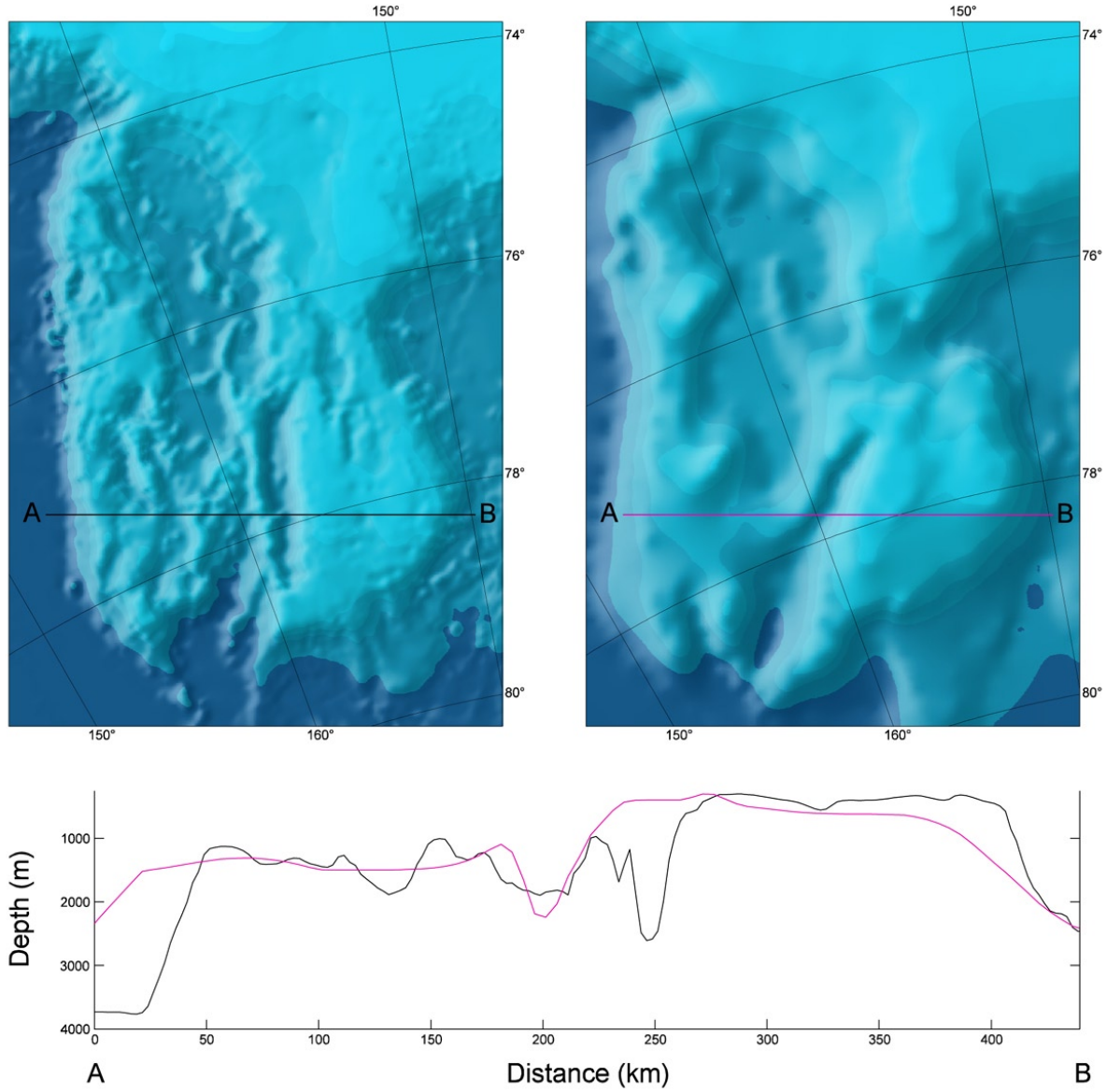

Figure 4. A comparison of the Northwind Ridge and the Chukchi Cap in the Chukchi Borderland, portrayed by IBCAO (left) and GEBCO (right)

On the IBCAO map, these features appear to be more highly segmented than on previous maps, and their surfaces display irregularities that suggest complex sea-floor processes (Figure 4).

The continental shelves of the Eastern Siberian and Laptev Seas

The shelf areas of the Eastern Siberian and Laptev Seas are shallow, generally less than 50 m deep, with a very flat relief.

With a 50 m minimum depth contour, the GEBCO map reveals very little bathymetric information over these huge shelf areas. On the other hand, a shaded relief implementation of the IBCAO map is effective at portraying depth variations of only tens of metres, accentuating the shallow paleo-river valleys that incise these areas, along with low-relief erosional and depositional features (Figure 5).

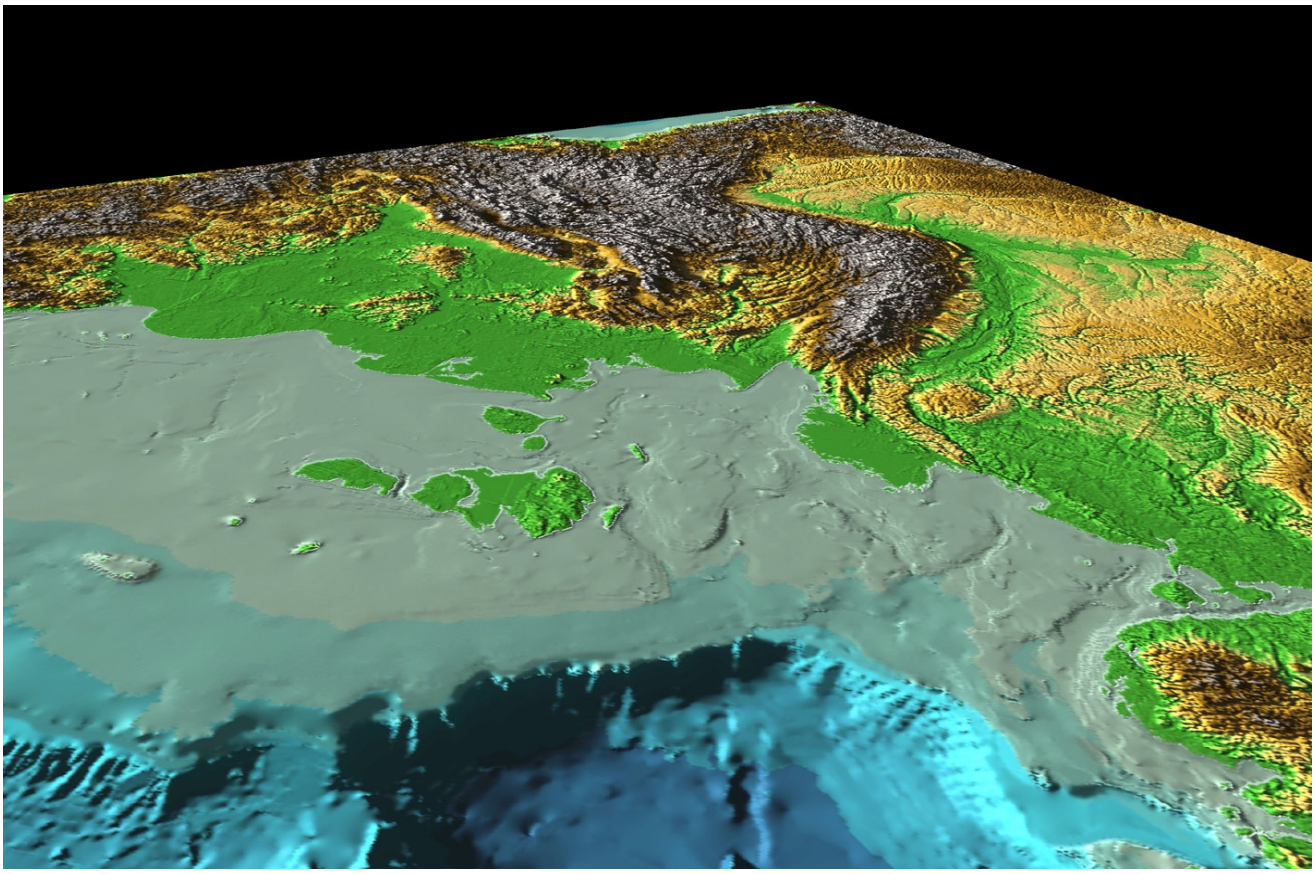

Figure 5. Oblique view of the continental shelves of the Eastern Siberian and Laptev Seas. The coloration of shallow regions is not the same as in Figures 1-4 on account of a different shading technique that was applied to emphasize low-relief features.

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